# THE GEOLOGY OF PART OF THE WOOSUNG QUADRANGLE

BY

JUSTUS STEVENS TEMPLETON

A.B., Princeton University, 1936

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN GEOLOGY IN THE GRADUATE SCHOOL OF THE UNIVERSITY OF ILLINOIS, 1940

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# THE GEOLOGY OF PART OF THE WOOSUNG QUADRANGLE


## Abstract

*Location.* The Woosung Quadrangle is located in northwestern Illinois and includes parts of Carroll, Ogle, Lee, and Whiteside Counties. It is bounded east and west respectively by the meridians of 89° 30′ and 89° 45′ W., and south and north respectively by the parallels of 40° 45′ and 42° N. The area discussed in this report comprises the topographically mapped central portion of the quadrangle, and has an area of 70 square miles.

*Physiography.* The elevation of the area varies between 637 feet and 847 feet, giving a maximum relief of 210 feet. The region is a gently rolling upland plain, thinly mantled with glacial drift, which has undergone a moderate degree of erosion by Rock River, the master stream of the area, and its tributaries. It is in a physiographic stage ranging from early youth in the southern part to mid-youth in the northern portion. Low hills and knolls of glacial gravels, together with rock outcrops on hillsides and along stream valleys, are commonly scattered over the northern two-thirds of the upland, but are rare in the southern third, which has undergone a second period of glaciation. The northern margin of the Alexandrian limestones forms a ridge of low to moderate relief trending approximately east and west across the southern part of the area. Both Rock River and its tributaries are bordered by a series of Pleistocene sand and gravel terraces of differing ages and elevations. Many of the streams occupy partially drift-choked pre-glacial bed-rock valleys, while others, incised in the till or bed-rock of the upland plain, are of post-glacial origin.

*Stratigraphy.* The Woosung area is underlain by the Pre-Cambrian basement at a probable depth of 2000 feet. Unexposed formations consist of approximately 1500 feet of upper Cambrian sandstone with subordinate amounts of shale and dolomite, succeeded in ascending order by the lower Ordovician Oneota dolomite, New Richmond sandstone, and Shakopee dolomite, and the middle Ordovician St. Peter sandstone, Platteville limestone, and Decorah limestone, which together total about 500 feet in thickness.

The oldest exposed formation in the Woosung area is the Galena dolomite of the middle Ordovician Trenton group, which attains an average thickness of 200 feet. The Galena formation is a crystalline, medium to coarse-grained, porous dolomite of a yellow-buff to gray-buff color, in beds 2 to 3 feet thick. Chert lenses are common in the lower two-thirds of the formation.

Chiefly on the basis of faunal differences and to lesser extent on lithologic variations, the Galena has been divided in ascending order into the Prosser, Stewartville, and Dubuque members, all of which crop out in this area or the immediate vicinity.

Only the upper 100 feet or *Fusispira* zone of the Prosser member is exposed. It is characterized by its coarser grain size and the presence of chert nodules. Index fossils of the Prosser found in this area are:

| | |
|---|---|
| *Rafinesquina deltoidia* | *Vanuxemia hayniana* |
| *Ctenodonta oviformis* | *Bellerophon platystoma* |
| *Modiolodon patulus* | *Fusispira subfusiformis* |
| *Saffordia modesta* | *Lophospira medialis* |

The Prosser underlies the Stewartville member with apparent conformity and is correlated with the Upper Hull and Sherman Fall formations of western New York.

The Stewartville is 40 feet thick and is distinguished by a medium-grained texture and the rare occurrence of chert nodules. The upper *Receptaculites* zone, about 10 feet thick, occurs at its base, but the genera *Maclurina* and *Maclurites, Lambeoceras* and *Westonoceras,* so distinctive of the Stewartville in Minnesota and Iowa, are apparently absent in the Woosung Quadrangle. Index fossils of the Stewartville in this area are:

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|---|---|
| *Coelocaulus oehlerti* | *Lophospira minnesotensis* |
| *Lophospira augustina* | *Potioceras apertum* |

The Stewartville is correlated with the Upper Coburg of the standard section, no equivalent of the lower Coburg having been recognized in the Galena formation.

The Dubuque member is approximately 30 feet thick, and consists of fine-grained, thin-bedded, buff dolomite with thin films of green clay along the bedding planes. No chert was discovered in this member. Index fossils of the Dubuque in this area are:

*Dalmanella corpulenta*
*Pseudolingula iowensis*
*Pseudolingula philomela*
*Rafinesquina camerata*

The Dubuque probably conformably overlies the Stewartville and disconformably underlies the succeeding Maquoketa formation, although the actual contacts are unexposed. The Dubuque is correlated with the Collingwood shale of western New York.

The Maquoketa formation of the upper Ordovician Richmond group is about 200 feet in thickness and consists of alternating beds of massive, unindurated, calareous green clay shale and argillaceous, fine to coarse-grained, buff to gray-blue dolomitic limestone. The basal *Depauperate* zone is probably present but does not crop out. Lithologic and faunal equivalents of the *Isotelus* zone near the base, and of the *Cornulites* zone at the top of the standard Maquoketa section of northwestern Iowa have been recognized in the Woosung Quadrangle, but correlation of the intervening strata with the Iowa section is uncertain. Characteristic or abundant fossils of the Maquoketa in this area are:

*Hallopora subnodosa*
*Monotrypa rectimuralis*
*Hebertella sinuata prestonensis*
*Leptaena unicostata*
*Platystrophia acutilirata*
*Rhyncotrema anticostiensis*
*Rhyncotrema capax*
*Sowerbyella sericeus*
*Cornulites sterlingensis*
*Isotelus iowensis*

The Maquoketa is disconformably overlain by the Edgewood limestone of the lower Silurian Alexandrian series, which varies between 7 and 10 feet in thickness. The Edgewood consists of massively bedded, medium to coarse-grained, crystalline, dolomitic limestone of a green-gray color when fresh, which becomes buff-colored, thin-bedded, and earthy textured after prolonged weathering. The bedding planes are covered with ropy algal structures and coated with green clay. A reef structure is present in the river bluffs above Sterling. Abundant or distinctive fossils in the Edgewood of the Woosung area are:

*Favosites niagarensis*
*Halysites gracilis*
*Lyellia thebesensis*
*Zaphrentis subregularis*
*Rhyncotreta thebesensis*
*Schuchertella missouriensis*
*Watsella edgewoodensis*
*Cyclonema daytonensis*

The youngest bed-rock formation in the area is the Kankakee limestone, also of the lower Silurian Alexandrian series, which disconformably overlies the Edgewood and attains a maximum thickness of 40 feet. It consists of fine to medium-grained, crystalline, highly dolomitic, buff limestone in layers 1 to 2 feet thick, interbedded with remarkably uniform and persistent bands of white chert. The *Platymerella* zone at the base of the Kankakee in northeastern Illinois is absent here, as throughout northwestern Illinois and Iowa. The *Stricklandinia* zone at the top of the formation was doubtless once present but has been removed by erosion. Characteristic fossils of the Kankakee in the Woosung Quadrangle are:

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|---|---|
| *Favosites favosus* | *Dolerorthis flabellites* |
| *Halysites catenularia* | *Cyclonema daytonensis* |
| *Zaphrentis stokesi* | *Illaenus daytonensis* |

Deposits of post-Kankakee, pre-Illinoian age are of two types. (1) Cave-fillings in the Kankakee limestone, consisting of soft, massive, blue-gray, clayey silt, which may be of early Pennsylvanian age, and (2) dark red, cherty, residual clays, probably of late Tertiary or early Pleistocene age, which were developed on the surface of the Galena dolomite prior to the Illinoian glaciation.

*Pleistocene Geology.* The earliest known Pleistocene deposit is the Illinoian drift, which covers the entire area but is exposed only in the northern half. It is overlain by early Wisconsin drift in the southern portion of the area. The thickness of the Illinoian drift varies from 0 to at least 90 feet and averages 13 feet. When fresh it consists of blue-gray calcareous clay, containing large amounts of sand and gravel, with some large boulders which are chiefly crystalline erratics. Where exposed to weathering it has been oxidized to a yellow or red-brown color and leached of carbonates. Isolated hills and kames of poorly sorted and stratified sand and gravel rise above the surface of the upland till sheet. Three separate terraces of similar material occur along and within the pre-glacial bed-rock stream valleys of the area. These deposits substantiate Flint's conclusion that the Illinoian ice-sheet stagnated and that such

gravels were laid down in ice-choked lakes, whose levels were controlled by bed-rock spillways and ice-dams southwest of this area. Transported ledges, or knolls of bed-rock sheared from their foundations by the lateral pressure of the ice-sheet and transported some distance from their original position, also occur in the area.

During the early Sangamon interglacial stage, succeeding the Illinoian glaciation, the upper portion of the Illinoian drift of this area was weathered into gumbotil, mesotil, or silttil, depending upon local conditions of drainage. Loess deposited during the late Sangamon stage was encountered in auger borings beneath later deposits but was not recognized in any surface exposures. Loess of Iowan-Tazewell, or Peorian, age is also extensively developed, reaching an average thickness of 7 feet and forming a discontinuous mantle over the Illinoian-Sangamon drift sheet. This later loess both underlies and overlies the early Wisconsin Shelbyville till sheet, having been continuously deposited from the Iowan through the early Tazewell subages.

The southern half of the Woosung Quadrangle is covered by drift of the Green River Lobe of the Shelbyville, or early Tazewell, glaciation. The Shelbyville drift consists principally of till, with minor amounts of outwash and kame gravels, and probably averages about 12 feet in thickness. Although no trace of a terminal moraine exists here, the respective areas covered by the Illinoian and Wisconsin ice-sheets can be differentiated by differences in the degree of erosion, drainage development, oxidation and decomposition, by stratigraphic relations, and most accurately by differences in the depth of leaching as determined by auger borings. Fifty borings in Illinoian till showed an average depth of leaching of 10.5 feet, while 135 borings in Shelbyville till showed an average depth of only 6.0 feet. A total of 350 borings, varying from 6 to 14 feet in depth, were made at intervals of $\frac{1}{8}$ mile to determine the boundaries between Illinoian till, Shelbyville till and outwash, and Tazewell-Recent lake and stream deposits, on the basis of relative depths of leaching and differences in lithology.

The higher of a pair of prominent gravel terraces along Rock River is tentatively correlated with outwash from the terminal moraine of the Bloomington, or late Tazewell, glaciation to the southeast. The lower terrace is correlated with the outwash of the Green Bay lobe of the Valparaiso ice sheet, which constituted the third or middle Wisconsin glaciation in northeastern Illinois and Wisconsin.

Tazewell-Recent lacustrine, stream, and swamp deposits, consisting of clays, silts, sands, gravels, and peat, which are locally highly fossiliferous, are extensively developed along the present stream courses of the area in the form of a series of terraces. Although 40 species of early Pleistocene to Recent invertebrates were collected from these deposits, their age and correlation with the substages of the Wisconsin glaciation cannot be exactly determined either from the field or faunal evidence available.

*Structural Geology.* The Woosung Quadrangle is located on the south flank of the Savanna anticline, whose crest extends east and west through Carroll County, 10 miles to the north, and on the west flank of the LaSalle anticline, whose crest trends north-northwest through Lee and Ogle Counties, 10 miles to the east. The bed-rock of the area has been folded into a shallow syncline having dips of from 1° to 5° on its flanks and pitching gently less than 1° to the southwest. Small but relatively sharp anticline upwarpings, with local dips as high as 18°, occur at two points within the major synclinal structure. The age of the deformation cannot be more closely dated than post-Kankakee, although regional evidence indicates that it is very probably at least post-Niagaran.

## VITA

Justus Stevens Templeton was born at Princeton, Illinois, on July 11, 1914. After receiving his college preparatory training at the Harris School, Chicago, and the Dixon Public High School, Dixon, Illinois, he attended Princeton University, where he received the degree of Bachelor of Arts in 1936. From 1936 to 1938 he was enrolled in the University of Wisconsin for graduate studies in geology, which he has continued during the past year at the University of Illinois. During the summer of 1935 he acted as field assistant to Professor Paul MacClintock of Princeton University in a study of the Pleistocene geology of Nebraska and South Dakota, and during the summers of 1937 and 1938 was engaged in field work on the Woosung Quadrangle, under the auspices of the Illinois State Geological Survey.